AMENDMENTS

IN THE SPECIFICATION:

Please amend the Title as follows:

A ~~METHOD AND APPARATUS~~ MULTI-FUNCTION UNIT OF A GRAPHICS SYSTEM FOR UPDATING A HIERARCHICAL Z BUFFER

Please amend the Summary as follows:

The present invention provides a ~~method and an apparatus~~ multi-function unit for occlusion testing primitives being processed in a graphics system and for updating a Z pyramid data structure used for occlusion testing on the fly. ~~The apparatus comprises logic configured to~~ The multi-function unit creates the Z pyramid data structure and ~~to~~ performs occlusion testing. The Z pyramid data structure comprises a plurality of levels, each of which comprises a plurality of regions. Each region comprises a plurality of subregions, each of which corresponds to a single Z value. Each region corresponds to a plurality of Z values and has a maximum region Z value, which corresponds to the largest Z value of the region. The logic multi-function unit compares the minimum Z value of each primitive with the Z value of a region associated with the primitive to determine whether or not the primitive is fully occluded.

If a determination is made that the primitive is not fully occluded, the ~~logic~~ multi-function unit determines whether or not any subregion of the region associated with the primitive is fully covered by the primitive. If the ~~logic~~ multi-function unit determines that a subregion is fully covered by the primitive, then the ~~logic~~ multi-function unit determines whether or not the Z value of the covered subregion needs to be replaced with the maximum Z value of the tested primitive. In order for the ~~logic~~ multi-function unit to determine whether the Z value of the covered subregion needs to be replaced with the maximum Z value of the primitive, the ~~logic~~ multi-function unit determines whether or not the maximum Z value of the primitive is less than the Z value for the covered subregion.

If the ~~logic~~ multi-function unit determines that the maximum Z value of the primitive is less than the Z value for the covered subregion, then the Z value for the

covered subregion is replaced with the maximum Z value of the primitive. Preferably, the ~~logic~~ multi-function unit maintains a coverage mask for each level of the Z pyramid data structure. Each coverage mask comprises a bit for each subregion of the level of the Z pyramid data structure associated with the coverage mask. When the ~~logic~~ multi-function unit determines that the maximum Z value of the primitive is less than the Z value for the covered subregion, a bit in the coverage mask associated with the covered subregion is set. When all of the coverage mask bits corresponding to the subregions of a particular region have been set, a bit is set for the corresponding region in the coverage mask associated with the next level up in the Z pyramid data structure.

When all of the bits in the coverage mask have been set for a particular region, the ~~logic~~ multi-function unit replaces the maximum Z value for the particular region with the maximum Z value of all of the subregions associated with the particular region. When all of the bits in the coverage mask have been set for a particular region in the coverage mask, the ~~logic~~ multi-function unit sets the corresponding bit in the coverage mask for the next level up in the Z pyramid.

Preferably, the primitives are occlusion tested in a tiler component of the graphics system and the Z pyramid data structure is updated by the tiler component on the fly as primitives are being processed through the graphics system. The graphics system is comprised as part of a computer graphics display system. The Z pyramid data structure preferably is ~~stores~~ stored in a Z pyramid memory element, which is in communication with the tiler. Preferably, the Z pyramid memory element is periodically updated with pixel level Z values, i.e., with Z values of primitives which have been scan converted into screen coordinates corresponding to locations on the display monitor. In this way, the Z pyramid data structure can be updated on the fly and can be periodically updated with pixel level Z values to ensure accurate occlusion testing.

Please amend the Abstract as follows:

A ~~method and apparatus~~ multi-function unit for occlusion testing primitives being processed in a graphics system and for updating a Z pyramid data structure used for occlusion testing. The Z pyramid data structure is updated on the fly, i.e., as primitives are being occlusion tested. The apparatus comprises ~~logic~~ multi-function unit is configured to create the Z pyramid data structure and to perform occlusion testing. The Z pyramid data structure comprises a plurality of levels, each of which comprises a plurality of regions. Each region comprises a plurality of subregions, each of which corresponds to a single Z value. Each region corresponds to a plurality of Z values and has a maximum region Z value, which corresponds to the largest Z value of the region. The ~~logic~~ multi-function unit compares the minimum Z value of each primitive with the maximum Z value of a region associated with the tested primitive to determine whether or not the tested primitive is fully occluded. Coverage masks are maintained by the ~~logic~~ multi-function unit for the different levels of the Z pyramid data structure to enable the Z pyramid data structure to be updated on the fly. When certain bits in the coverage masks are set, the ~~logic~~ multi-function unit causes the Z pyramid data structure to be updated.